UNIVERSITI PUTRA MALAYSIA

MANAGEMENT OF SAMBAR DEER (CERVUS UNICOLOR BROOKEI) UNDER AGROFORESTRY SYSTEM IN SARAWAK

DAWEND JIWAN

MANAGEMENT OF SAMBAR DEER (*CERVUS UNICOLOR BROOKEI*) UNDER AGROFORESTRY SYSTEM IN SARAWAK

By

DAWEND JIWAN

Thesis Submitted in Fulfilment of the Requirement for the Degree of Master of Science in the Faculty of Agriculture Universiti Putra Malaysia

May 2001

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

MANAGEMENT OF SAMBAR DEER (*CERVUS UNICOLOR BROOKEI*) UNDER AGROFORESTRY SYSTEM IN SARAWAK

By

DAWEND JIWAN

May 2001

Chairman : Professor Dr. Dahlan Ismail, Ph.D.

Faculty : Agriculture

Sambar deer breeding under existing forest plantation with local Sabal Tapang community participation was one of the Agroforestry projects implemented in Sarawak aimed at bringing socio-economic benefits to the shifting cultivators and to strike a balance in nature conservation.

The research and observation conducted during the implementation of this agroforestry deer breeding focused on the animal performance, initial effect of deer browsing behaviour on the plantation and attitude and perception of adjacent communities towards the overall agroforestry systems in Sabal.

Brody's Growth Model was the most suitable model for deer production under this system. The appropriate age of venison production was about two years when the animal weighed around 74.2 kg. Sambar deer was found to have no definite breeding season. The sex ratio of fawn male to female was 1:1.5, female became

sexually mature at 23.1 months, fawning interval was 11.3 months and gestation was 257 days. The period of stag which did not cause damage to vegetation was 4.7 months compared to the long period of 6.9 months of destructiveness to the trees stand as a result of rubbing and territorial marking.

There were 22 known families of woody plant and another 10 families of non-woody plant found in the 12-year old *Acacia mangium* plantation. A total of more than 21 species were eaten by 14 heads of Sambar deer over a total observation of 65 days within an area of 8.0 ha. Sambar deer browsing was highest in *Ficus spp.* (34%) for all leaves, fruits and bark; followed by *Dillenia sp.* shoots (30%); *Agrostistachys sp.* leaves (8%) and *Macaranga spp.* leaves (7%). The maximum limit of browsing was observed at height of 4 m with diameter of less than 3.8 cm. The browsing pattern based on nutritional selectivity was shown in species with high dry matter digestibility, crude protein, fibre, potassium, calcium, copper and zinc content. The other factors affecting the browsing pattern were microhabitat and closeness to perimeter fence. It was found that more than 70 percent of tracks and trampling happened near to stream and near to fence compared to only 20 percent observed in the middle of paddock.

The criteria for villages acceptance of agroforestry projects were (1) ease of management; (2) fast economic returns; (3) proximity to village and; (4) involving direct participation of local people in most of the activities.

With the knowledge on the findings made, this system definitely addresses the call for sustainability of production as highlighted in the Third National Agricultural Policy which emphasize on exploitation of indigenous species and integrated farming.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
sebagai memenuhi keperluan untuk Ijazah Sarjana Sains

PENGURUSAN RUSA SAMBAR (*CERVUS UNICOLOR BROOKEI*) DI BAWAH SISTEM HUTAN-TANI DI SARAWAK

Oleh

DAWEND JIWAN

Mei 2001

Pengerusi : Profesor Dr. Dahlan Ismail, Ph.D.

Fakulti : Pertanian

Pemeliharaan rusa Sambar tempatan di dalam ladang hutan sedia ada, dengan penyertaan oleh penduduk Sabal Tapang merupakan salah satu projek Hutan-tani yang dilaksanakan di Sarawak. Ia bertujuan untuk memberi keuntungan sosio-ekonomi kepada masyarakat pertanian pindah dan dalam mengimbangi pemeliharaan alam sekitar.

Semasa pelaksanaan projek ini, kajian dan pemerhatian yang dibuat ialah mengenai keupayaan rusa Sambar, kesan awal sifat pemakanan rusa ke atas ladang hutan dan sikap penduduk tempatan terhadap program hutan-tani.

Keterangan mengenai model pertumbuhan rusa sambar projek ini adalah lebih sesuai menggunakan Model Pertumbuhan Brody. Usia rusa sambar yang sesuai untuk pengeluaran daging adalah di antara dua tahun apabila beratnya di dalam lingkungan 74.2 kilogram. Pembiakan rusa sambar didapati tidak bermusim,

nisbah anak jantan:betina adalah 1:1.5, betina mencapai peringkat mengawan pada umur 23.1 bulan, jarak peranakan adalah 11.3 bulan dan mengandung selama 257 hari. Rusa jantan didapati mempunyai tanduk keras selama 6.9 bulan dan akan mengakibatkan kerosakan pada batang pokok berbanding dengan 4.7 bulan semasa tanduk gugur dan tumbuh semula.

Terdapat 22 jenis keluarga kayu dan 10 jenis keluarga bukan kayu di dalam ladang *Acacia mangium* yang berusia 12 tahun di Sabal. Kajian pemerhatian selama 65 hari dalam kawasan seluas 8 hektar mendapati bahawa lebih daripada 21 spesis tumbuhan telah dimakan oleh 14 ekor rusa. Spesis yang paling kerap dimakan oleh rusa adalah mengikut urutan seperti *Ficus spp.* (34%) merangkumi daun, buah dan kulit; pucuk *Dillenia sp.* (30%); daun *Agrostistachys sp.* (8%) dan daun *Macaranga spp.* (7%). Rusa sambar boleh mencapai pemakanan pada ketinggian maksima 4 meter pokok kayu dengan garis pusat 3.8 sentimeter. Corak pemakanan rusa adalah berasaskan pemilihan mengikut nilai kandungan zat seperti penghadaman berat kering, protein, gentian, kalium, kalsium, kuprum dan zink yang tinggi. Faktor-faktor lain menentukan corak pemakanan rusa adalah mikrohabitat dan jarak dari tepi pagar. Kajian mendapati lebih daripada 70 peratus kesan tapak dan penggunaan oleh rusa sambar letaknya di kawasan sekitar anak sungai dan tepi pagar berbanding hanya 20 peratus di kawasan pertengahan keseluruhan kawasan.

Kriteria penerimaan projek hutan masyarakat/hutan-tani oleh penduduk tempatan adalah berasaskan pada (1) tahap pengurusan yang mudah; (2) cepat

mengeluarkan hasil pulangan; (3) berdekatan dengan tempat kediaman dan; (4) melibatkan penyertaan mereka secara langsung dalam semua aktiviti.

Dengan pengetahuan yang diperolehi, sistem ini sememangnya mapan dan seiring dengan cabaran yang disarankan dalam Polisi Pertanian Nasional Ke-3 (1998-2010) yang menggalakkan penggunaan spesis tempatan dan perladangan integrasi.

ACKNOWLEDGEMENTS

I am greatly indebted to many people who have assisted me directly and indirectly in my pursuit for this Master of Science program and the preparation of my dissertation. It is through God guided belief, wisdom and patience, harmonious working relationship and our own diligent effort that all things are made possible. Thank you everyone for your contribution.

First and foremost, I would like to thank my Main Supervisor Professor Dr. Dahlan Ismail and my other Panel of Supervisors namely Professor Dato' Dr. Nik Muhamad Ab. Majid, Associate Professor Dr. Mohd. Ridzwan Abd. Halim and Associate Professor Dr. Andrew Alek Tuen. This thank also goes to Associate Professor Dr. Liang Juan Boo who chaired the *viva voce* for this thesis. They all have done a tremendous job in giving their comments and invaluable supervision in my course of preparing this thesis. To my Associate Supervisor/Advisor Datuk Leo Chai Chia Liang, I greatly appreciate your kind and moral support.

Since the partial funding of this project comes under IRPA Project No. 01-04-06-0009, my appreciation goes to the Ministry of Science and Environment, Malaysia.

My sincere thanks also goes to few persons in the higher authorities for approving this study, giving me time off and leave during the course of my study. They are the State Secretary Office personnel and those from the Forest Department, Sarawak, in the person of Mr. Cheong Ek Choon (Director of Forests), Dr. Lee Hua Seng, (Deputy Director), Abang Hj. Abdul Hamid Abang Karim, (former Senior Assistant Director of Forest Research Centre), Mr. Joseph Jawa Kendawang (Assistant Director of Reforestation Division) and Mr. Francis Chai Yan Chiew (former Assistant Director of Reforestation Division).

To EF Rufus Jonathan Alek, T/EF Anna Busang, T/RA Hilary J. Petrus, FO Hj. Othman Ismawi, FO Halipah Bujang, FG Willis Kati, Tracer Roslind Lai, PRA Jimmy Ng Ting Seng, Ms. Mommy and all those whom I have not mentioned here. Thank you for your hard work in being part of this research.

My appreciation also goes to Dr. Wattanachant C. for his contribution to my deer growth model, Mdm. Chin Siew Phin and Mdm. Margaret Aban, both Chemists from Agriculture Research Centre, Semengoh, for their effort in assisting in nutritive analysis of browse species eaten by deer. This special thank also goes to Mr. Kamil Salem and NONAKRAF Communications video production crews/staff for their excellent work in producing the VCD on this project. To Mr. Harlem Perry, thank you for your assistance in producing the digitized map of Sabal. I wish to extend my appreciation also to Pastor Petrus Ngadan Kuju (M.A.H.M. and M.P.H.) and Mr. Leonard Ope, qualified English Teacher (TESL) at Sunny Hill School for proof reading and checking on the grammar usage in most of this thesis.

I thank the University Putra Malaysia Graduate School for accepting my Master of Science Program.

Last but not the least, my deep appreciation goes to my wife Josephine Jame, father, mother, brothers, sisters and cousin Adrian Sukui for their love, concern, support and earnest prayers that always inspire me to achieve greater height in my undertaking.

The list goes on but to those whose names do not appear, I pray that God will reward you accordingly and please accept my apology. It is through trusting God, His constant guidance and many blessings that all the work is possible and the shortcomings/challenges along the way are trials towards making us forming our true character. **Amen.**

I certify that an Examination Committee met on 14th May 2001 to conduct the final examination of Dawend Jiwan on his Master Science thesis entitled "Management of Sambar Deer (*Cervus unicolor brookei*) under Agroforestry Programme in Sarawak" in accordance with Universiti Pertanian Malaysia (Higher Degree) Act 1980 and Universiti Pertanian Malaysia (Higher Degree) Regulations 1981. The Committee recommends that the candidate be awarded the relevant degree. Members of the Examination Committee are as follows:

Dahlan Ismail, Ph.D.
Professor
Faculty of Agriculture
Universiti Putra Malaysia
(Chairman)

Dato' Dr. Nik Muhamad Ab. Majid, Ph.D.
Professor
Faculty of Forestry
Universiti Putra Malaysia
(Member)

Mohd. Ridzwan Abd. Halim, Ph.D.
Associate Professor
Faculty of Agriculture,
Universiti Putra Malaysia
(Member)

Andrew Alek Tuen, Ph.D.
Associate Professor
Faculty of Resource Science and Technology
Universiti Malaysia Sarawak
(Member)

MOHD. GHAZALI MOHAYIDIN, Ph.D.
Professor/Deputy Dean of Graduate School
Universiti Putra Malaysia

Date : 01 AUG 2001

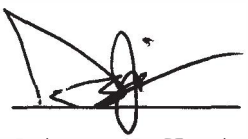
This thesis submitted to the Senate of Universiti Putra Malaysia has been accepted as fulfilment of the requirement for the degree of Master of Science.

AINI IDERIS, Ph.D.
Professor
Dean of Graduate School,
Universiti Putra Malaysia

13 SEP 2001
Date : August, 2001

DECLARATION FORM

I hereby declare the thesis is based on my original work except for the quotations and citations which have been duly acknowledged. I also declare that it has not been previously or concurrently submitted for any other degree at UPM or other institutions.



DAWEND JIWAN

Date : 31 July, 2001

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS / GLOSSARY OF TERMS

ADF	- Acid Detergent Fibre
CF	- Crude Fibre
CITES	- Convention on International Trade in Endangered Species
CP	- Crude Protein
DM	- Dry Matter
DMD	- Dry Matter Digestibility
DOA	- Department of Agriculture
EE	- Ether Extract
GE	- Gross Energy
IRAD	- Integrated Rural Area Development
IRPA	- Intensive Research Priority Area
ITTO	- International Tropical Timber Organisation
MAFF	- Ministry of Agriculture, Fisheries and Food
M.A.H.M.	- Master of Art in Health and Ministry
MARDI	- Malaysian Agricultural Research and Development Institute
ME	- Metabolisable Energy
MEA	- Metabolisable Energy Available
MER	- Metabolisable Energy Required
M.P.H.	- Master of Public Health
MRB	- Malaysian Rubber Board
NAP3	- Third National Agriculture Policy (1998 – 2010)
NCR	- Native Customary Right
NDF	- Neutral Detergent Fibre
NZTCI	- New Zealand Technical Correspondence Institute
OPF	- Oil Palm Frond
PFE	- Permanent Forest Estate
TPA	- Totally Protected Area

CHAPTER 1

INTRODUCTION

1.1 Overview on Agroforestry

Agroforestry was brought from the realm of indigenous knowledge into the forefront of agricultural research less than two decades ago, and was promoted widely as a sustainability-enhancing practice that combines the best attributes of forestry and agriculture (Bene *et al.*, 1977, Steppler and Nair, 1987). Agroforestry is one of the activities usually implemented under the community forestry programme. The definition of Agroforestry has been much debated but what make up of all agroforestry systems according to Nair (1993) are the possession of three attributes as follows:-

a. Productivity : Most, if not all agroforestry systems aim to maintain or increase production (of preferred commodities) as well as productivity (of the land);

b. Sustainability : By conserving the production potential of the resource base, mainly through the beneficial effects of woody perenials on soils, agroforestry can achieve and indefinitely maintain conservation and fertility goals;

c. Adaptability : Agroforestry has already been accepted by the farming